

We

claim:

1. A coal pyrolysis pretreatment apparatus comprising a pretreatment vessel for holding a bed of coal particles, a preheater for heating the bed of coal particles to a temperature below the coal pyrolysis temperature range, an enclosure around the vessel for preventing air from contacting the bed of coal particles, and ~~an oxygen remover~~ ^{at very low oxygen sweep gas or a vacuum} for removing the oxygen released from the heated coal particles and transporting it away from the enclosure so that the partial pressure of oxygen in the pretreatment region is kept low.

2. The apparatus of claim 1, further comprising an inlet for feeding coal particles to the vessel and an outlet for removing particles from the vessel.

3. The apparatus of claim 1, further comprising a pyrolysis retort near the vessel and transfer passages for transferring heated coal particles from the pretreatment vessel to the pyrolysis retort while preventing entry of air.

4. The apparatus of claim 1, wherein the pretreatment vessel further serves as a dryer for removing moisture from the coal.

5. The apparatus of claim 1, further comprising a vibrating machine connected to the vessel for vibrating the vessel and providing rapid mixing and heating of coal particles entering the bed from the input to provide uniform removal of oxygen from coal particles.

A.P.F. & H.L.F.
4-2-97

6. The apparatus of claim 1, further comprising a gas inlet connected to the vessel for contacting the coal particles in the bed with a sweep gas of low oxygen content, and a gas outlet connected to the enclosure for removing the sweep gas before the oxygen extracted from the coal particles builds up in the sweep gas and inhibits the deoxidation process.

7. The apparatus of claim 6, further comprising a flue gas source connected to the gas input for supplying low oxygen concentration flue gas as an oxygen removal sweep gas to the bed of coal.

8. The apparatus of claim 1, further comprising a collector for collecting non-condensable combustible gases from coal pyrolysis, and a burner for partially burning the collected non-condensable combustible gases and supplying hot, partially combusted non-condensable gases from the burner to the bed of coal particles to serve as a sweep gas for heating and removing oxygen from the bed of coal particles.

9. The apparatus of claim 6, further comprising a source of carbon monoxide connected to the gas input for supplying carbon monoxide to the bed of coal particles and removing oxygen from the coal particles with the carbon monoxide.

10. The apparatus of claim 1, wherein the heater comprises a furnace holding ceramic balls of a size larger than coal particles in the bed, and provisions for circulating the ceramic balls from the furnace to the bed of coal particles for heating

the coal particles in the pretreatment vessel and recycling the balls through the furnace for reheating.

11. A coal pyrolysis pretreatment process comprising heating the bed of coal particles to a temperature below the coal pyrolysis temperature range, preventing air from contacting the bed of coal particles, and removing oxygen released from the heated coal particles from the enclosure before subjecting the coal to pyrolysis.

12. The process of claim 11, further comprising inputting coal particles to a pretreatment vessel and removing particles from the vessel.

13. The process of claim 11, further comprising transferring heated coal particles from the vessel to a pyrolysis retort near the vessel while preventing entry of air.

14. The apparatus of claim 11, further comprising removing moisture from the coal.

15. The process of claim 13, further comprising vibrating the vessel and providing rapid mixing and heating of coal particles entering the bed from the input to provide uniform removal of oxygen from coal particles.

16. The apparatus of claim 11, further comprising contacting the coal particles in the bed with an oxygen removal gas, and removing the oxygen removal gas with the oxygen removed from the coal particles.

17. The process of claim 16, further comprising supplying low oxygen flue gas as the oxygen removal gas to the bed of coal.

18. The process of claim 11, further comprising collecting non-condensable combustible gases from coal pyrolysis, and burning the collected non-condensable combustible gases for heating the bed of coal, and supplying partially combusted collected non-condensable gases from the burner to the bed of coal particles for removing oxygen from the bed of coal particles.

19. The process of claim 16, further comprising supplying carbon monoxide to the bed of coal particles and removing oxygen from the coal particles with the carbon monoxide.

20. The process of claim 11, wherein the heating comprises heating in a furnace ceramic balls of a size larger than coal particles in the bed, and circulating the heated ceramic balls from the furnace to the bed of coal particles for heating the coal particles in the vessel and recycling the balls through the furnace.

21. The process of claim 20, further comprising circulating some of the ceramic balls to the vessel for pretreating the coal by preheating the coal and removing oxygen, flowing coal from the pretreatment vessel to a pyrolysis retort and circulating some of the ceramic balls to the pyrolysis retort for pyrolysis of the coal.

22. The process of coal pyrolysis pretreatment using the apparatus of claim 1.

23. The process of coal pyrolysis pretreatment comprising contacting coal particles in a bed with an oxygen removal gas,

